

# GUIDELINES ON EXPORT CONTROL AND NONPROLIFERATION



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**Guidelines on Export Control**

**and**  
**Nonproliferation**

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## **GUIDELINES ON EXPORT CONTROL AND NONPROLIFERATION**

### **1.0 Purpose**

These guidelines are intended to help Department of Energy (DOE) Headquarters Offices, Operations Offices, Area Offices, laboratories, and contractors to implement a consistent and technologically sound policy regarding DOE transfers of unclassified equipment, materials, and information that could adversely affect U.S. nuclear nonproliferation objectives or national security.

Such transfers can occur through:

- Direct exports, Cooperative Research and Development Agreements (CRADAs), work-for-others, patent assignments, donations, or sales of surplus property or transfers to other federal, state, or other public agencies.
- International and domestic technical exchange programs.
- Publications.
- Presentations at conferences or other forums.
- Foreign national visits or assignments to DOE facilities.
- Foreign travel by DOE or DOE contractor employees.
- Other means of communication such as international telephone calls, faxes, e-mail, mailings, or placing DOE documents on the World Wide Web.

When unclassified equipment, materials, or information related to a nuclear or nuclear-related technology is transferred without restriction, among the beneficiaries may be nuclear proliferant or potential adversary countries. A list of countries that DOE considers sensitive for proliferation, national security, or terrorism reasons is given in Appendix 3.

Of special concern are transfers related to nuclear weapons design and production, special nuclear material (SNM) production, and the sensitive technologies of the nuclear fuel cycle. Particular caution should be exercised when transferring items especially designed or prepared for use in nuclear fuel cycle activities or the nuclear weapons program. These items have a greater probability of having elements of form, quality, or composition suited to a nuclear weapons program or the production of special nuclear material.

Unrestricted transfer to countries of concern is contrary to U.S. commitments under the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) and to U.S. nuclear nonproliferation policy and national security objectives as reflected in U.S. laws and regulations. DOE dismantlement of nuclear weapons, facilities, and related infrastructure makes the need for caution on transfers especially acute. Adherence to these guidelines will help to protect against the inadvertent transfer

of sensitive unclassified equipment, materials, or information inimical to the interests of the United States.

## **2.0 Policy**

By international treaties and agreements, statutes, and policy, DOE is committed to encouraging scientific and technical exchanges that are consistent with U.S. national security and nuclear nonproliferation objectives. The NPT obligates its nuclear-weapon state adherents not to help other countries acquire nuclear weapons technology but, at the same time, to facilitate the transfer

of technologies applicable to peaceful uses of nuclear energy to NPT adherents. DOE policy and procedures on the transfer of equipment and materials and the dissemination of scientific and technical information must balance the Department's commitment to U.S. nonproliferation and national security objectives with its commitment to U.S. technological progress and support for U.S. industry. These sometimes conflicting commitments may require imposing limits on such transfers, but only after careful consideration.

When it is necessary to control access to a technology, the primary means remains the classification system, augmented by the Unclassified Controlled Nuclear Information (UCNI) controls defined in Section 148 of the Atomic Energy Act. But legal, operational, scientific, or historical considerations may make it impractical, ill-advised, or even impossible to classify technology significant to national security or nonproliferation objectives. The transfer abroad of such unclassified technology is controlled by U.S. Government export laws and regulations.

For transfers of nuclear and nuclear-related equipment, materials and technology, U.S. Government export controls enforce the requirements of the Atomic Energy Act, the Nuclear Non-Proliferation Act, the Export Administration Act, and the Arms Export Control Act. These statutes and their implementing regulations require a license from the Department of Commerce (DOC), Nuclear Regulatory Commission (NRC), or Department of State (DOS) or an authorization from the Secretary of Energy before certain unclassified nuclear and nuclear-related commodities and technical information can be exported.

U.S. Government export control regulations reflect the export control lists of the Nuclear Supplier Group (NSG), an international organization of major nuclear supplier countries dedicated to nuclear nonproliferation. These NSG lists may be found in International Atomic Energy Agency Information Circular (INFCIRC) 254, as amended. The INFCIRC 254/Part 1 list comprises equipment and materials especially designed for nuclear application and is known as the "Trigger List" because the items on it "trigger" the imposition of International Atomic Energy Agency safeguards. The INFCIRC 254/Part 2 list comprises items which have both nuclear and non-nuclear applications and is known as the dual-use list.

Pursuant to its regulations 10 CFR Part 810, DOE reviews and either approves or denies private sector proposals to export certain technology, equipment, materials, or services that assist in the production of special nuclear material. DOE also reviews license applications submitted to

the Departments of Commerce and State, and the Nuclear Regulatory Commission for other nuclear and nuclear-related exports. DOE-sponsored activities often entail the transfer abroad of technical information, and sometimes equipment and materials. Private sector export of such items would be subject to U.S. Government export control review and approval; lack of an export control review and approval process for DOE-sponsored actions could defeat the intent of the NPT, U.S. laws and regulations, and U.S. international commitments.

These guidelines describe requirements and methods for DOE export control review. They are intended to:

- Help identify equipment, materials, and technical information requiring review and possible restriction.
- Encourage a reasoned weighing of proliferation and national security concerns against the value of scientific scholarship, technological advance, or economic benefit when considering transfers of controlled technology.

### **3.0 Scope**

These guidelines are applicable to all unclassified scientific and technical equipment, materials, and information in the possession or control of DOE or its contractors which a private firm or individual could not transfer lawfully to another country without an export license or authorization. They do not apply to requests for information submitted pursuant to the

Freedom of Information Act. The guidelines also do not apply to fundamental research as defined in National Security Decision Directive (NSDD) 189. Fundamental research, conducted to advance general knowledge, is normally not of export control concern. In extraordinary circumstances fundamental research may be classified if it is particularly significant to national security. These guidelines do not affect procedures for dealing with potential generation of classified information by fundamental research.

The areas of concern embrace the full range of technologies pertinent to nuclear proliferation and national security - nuclear, nuclear-related, and even non-nuclear. These areas are described in the Department of Defense's Militarily Critical Technologies List (MCTL) and DOE's Nuclear Technology Reference Book (NTRB), which describes nuclear technologies in much greater technical detail. However, discussion of a technology in the MCTL or the NTRB does not mean that all commodities associated with the technology require an export license. In this respect the MCTL and NTRB differ sharply from the NSG export control lists: all equipment, materials and technology listed by the NSG are export controlled by NSG member countries. Therefore, U.S. export control regulations cover all items on the NSG lists.

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<sup>1</sup> NSDD 189 defines fundamental research as "basic and applied research in science and engineering, the results of which ordinarily are published and shared broadly within the scientific community, as distinguished from proprietary research and from industrial development, design, production, and product utilization, the results of which ordinarily are restricted for proprietary or national security reasons."



Summary discussions of technology categories of concern to DOE are to be found in Appendix I and Appendix 2 of this document.

#### **4.0 Export Controls on Equipment, Materials, and Information**

Qualified DOE or DOE contractor personnel will conduct an export control review prior to transfer of equipment, materials, or information. This is required regardless of the method of transfer, e.g., public auction, donation, direct sale, cooperative program, work-for-other, transfers to other agencies, information exchange, public presentation, publication, foreign travel, shipment, mail, fax, e-mail or webpage (www).

#### **4.1 DOE Exports and Domestic Transfers**

If the transfer involves a direct export by DOE -- for example, a transfer of nuclear equipment or materials as part of a program of cooperation with another country -- DOE or a DOE contractor must obtain the necessary export license. However, if a transfer is made within the United States -- for example, in a public auction or in a CRADA agreement -- DOE or DOE contractor personnel responsible for the transfer will include export control guidance on the transferred equipment, materials, or technical information in the sale contract or other transfer agreement. The sale contract or other agreement also will require that DOE's export control guidance be passed on in the event of retransfer, including any domestic retransfer.

U.S. export controls on nuclear and nuclear-related commodities are published in DOE's regulations 10 CFR Part 810, "Assistance to Foreign Atomic Energy Activities"; Nuclear Regulatory Commission regulations 10 CFR Part 110, "Export and Import of Nuclear Materials and Facilities"; Department of Commerce Export Administration Regulations (EAR) 15 CFR Part 730-774, especially 15 CFR Part 744, "Control Policy: End-User and End-Use Based," the discussion of Technical Data in 15 CFR 734, and 15 CFR 774 (Commerce Control List); and Department of State regulations 22 CFR Parts 120-130, "International Traffic in Arms Regulations" (ITAR).

DOE and contractor personnel who are familiar with these export control regulations can generally determine the requirements for a given item without further assistance. Personnel not familiar with the regulations and how they apply to various nuclear or nuclear-related items will first consult the NSG control lists cited in Appendix 1 and, if they need greater technical detail, the nuclear-related sections of the MCTL, or the NTRB. In regard to nonnuclear items, personnel not familiar with export control regulations should consult the MCTL listings for non-nuclear technologies in Appendix 2. The NTRB and MCTL not only describe equipment, materials, and technical information and explain their uses, but also list the export controls that apply to each. Most important, almost all DOE sites have personnel who regularly deal in export control matters and can provide assistance as necessary.

## **5.0 Dissemination of Export Controlled Information**

Unrestricted public dissemination of DOE technical information - typically by publication or public presentation - poses special problems. A private firm or individual exporting information subject to export control requires an export license. If the proposed export raises nuclear proliferation concerns, the U.S. Government licensing agency can deny the license or attach restrictions to it - for example, requiring U.S. Government consent for any reexport of the information to another country.

Publication in a periodical of DOE technical information or its presentation at an international conference is tantamount to export in the sense that the information then becomes available globally - but without formal review by a licensing agency. For this reason, DOE personnel should take care not to give uncontrolled dissemination to technical information useful to nuclear proliferants. Such information should undergo internal DOE export control review prior to its public release.

### **5.1 How to Review for ECI**

The fact that technical information relates to items discussed in the NSG lists, the NTRB or MCTL is not sufficient reason to withhold it from public release; rather, it is a reason to review the specific information involved to determine whether limiting release is warranted.

By checking the NSG lists, and, if necessary, the MCTL and NTRB, the reviewer can establish whether the information, if proposed for export by a private firm or individual, would require a U.S. Government export license or authorization. If so, the reviewer will evaluate the significance

of the information by posing a series of questions:

- Could uncontrolled release of the information reasonably be expected to contribute to nuclear proliferation?
- Could uncontrolled release help a proliferate significantly to improve its ability to develop nuclear weapons or gain know-how for producing or preparing nuclear weapons materials?
- Could uncontrolled release reasonably be expected to adversely affect U.S. national security?
- Could an adversary country gain significant technical advantage, negate a U.S. advantage, or find it significantly easier to develop advanced weapons or make other military progress?
- Is the information of such character that association with its source - for example, a DOE weapons laboratory - would implicitly enhance its value to a proliferate or adversary?

If the reviewer concludes that unlimited dissemination would adversely affect U.S.

nonproliferation objectives or national security, the information will be designated ECI, with appropriate markings, and its *uncontrolled* dissemination, especially uncontrolled *foreign* dissemination, should be prevented. However, designation as ECI will not prevent sharing of the information among DOE or DOE contractor employees. With appropriate precautions, ECI also can be transferred under work-for-others agreements, exchanges based upon agreements for international cooperation, exchanges under U.S. approved programs of the International

Atomic Energy Agency, or exchanges with countries posing no proliferation or national security concerns. As noted earlier, a list of countries that DOE considers sensitive for nonproliferation, national security or terrorism reasons is at Appendix 3.

Markings to be affixed to technical information determined to be ECI may vary depending on the needs and preferences of site or program managers. The following format is preferred:

#### EXPORT CONTROLLED INFORMATION

Contains technical data whose export is restricted by statute. Violations may result in administrative, civil, or criminal penalties. Limit dissemination to U.S. Department of Energy employees and contractors. The cognizant program manager must approve other dissemination. This notice shall not be separated from the attached document.

Reviewer  
(Signature)

Date

Sites that have developed their own ECI marking formats may retain them as long as they contain at least the information elements of the preferred format.

## **6.0 Export Control Review Mechanisms**

Most DOE facilities, laboratories, and other sites already have developed organizations and structures to deal with technology security, export control review, declassification and related issues. Rather than attempt to replace these with a rigid one-size-fits-all scheme, DOE believes that existing mechanisms should perform the increased export control review responsibilities called for by these Guidelines, with sites modifying their present practices where necessary. The organizational structure should fit the needs of the site, with the result being an effective export control review program at each site.

DOE scientists and engineers, technology security experts, export control specialists, facility shipping offices, declassification officers, property management personnel, and legal departments all may have roles to play in the export control review process. Technical input by individuals familiar with the equipment, materials, or information involved may be essential to identifying potentially sensitive commodities or technologies or to determining applicable export controls. Such technical experts may also know best how, for example, to render proliferation-sensitive equipment useless to a nuclear proliferate but still useful for nonnuclear purposes or as scrap. At some sites, the certification that an export control review has been made may best be accomplished simultaneously with declassification review. Declassification offices will have copies of the NTRB, the MCTL, and the pertinent export control regulations.

## **6.1 Export Control for Property Transfers**

DOE property being transferred in surplus or other sales, donations, CRADAS, work-for-others agreements, cooperative agreements, inter-agency transfers, or technical exchange programs that is determined to be subject to export control will be designated as such. The recipients will be informed in writing of their responsibility to obtain required export licenses or authorizations for retransfer to another country. Recipients also will be required to pass on DOE's export control guidance if they retransfer the property domestically.

Export control review of surplus property may determine that it should be rendered useless for nuclear purposes before being offered to the public or that the sales agreement should require its disposal as scrap. In some cases, the review may determine that the property is too sensitive for sale or other transfer and, therefore, that it must be destroyed by DOE. Surplus equipment or materials especially designed or prepared for nuclear use will be either sold for scrap after being made useless for nuclear purposes or will be destroyed; the same will be done for weapons components. To establish whether equipment or materials are especially designed or prepared for nuclear use, consult Part 1 of the Nuclear Suppliers Group lists (INFCIRC 254). All items on the Part 1 list are especially designed or prepared. The rule that especially designed or prepared items or weapons components must be scrapped or destroyed may be appealed in individual cases. Such

appeals must be made through the cognizant Assistant Secretary to the Director of the Office of Nonproliferation and National Security. If the ultimate decision is to transfer especially designed or prepared equipment or materials, or weapons components, precautions must be taken

to prevent their use for purpose inconsistent with U. S. Government nonproliferation or national security policy. This may require physically modifying equipment prior to transfer, placing conditions in the transfer agreement, or both.

## **6.2 Transfer of ECI**

If technical information is determined to be ECI, it should be released domestically only to controlled distribution (such as a party to a CRADA or technical exchange agreement, the U.S. purchaser of surplus property, or organizations on the Office of Nuclear Energy's Applied Technology lists) and should be protected as far as legally allowable from release to foreign countries, organizations or individuals unless authorized by the appropriate Headquarters program manager. Such protection should be especially exercised -- again, as far as legally allowable -- for ECI sought by nationals of countries on the Sensitive Country List at Appendix 3.

ECI documents should not be made available on the Internet. A program manager or a reviewer may direct release of ECI to foreign recipients under a technical cooperation agreement; but the agreement itself will be reviewed and approved by the Department's Nuclear Transfer and Supplier Policy Division. As a rule, foreign nationals visiting or assigned to DOE facilities should

not have access to ECI; nor will DOE and DOE contractor employees traveling abroad disseminate ECI. Under current law, a report sought under the Freedom of Information Act may not be withheld on grounds that the report contains ECI.



### **6.3 ECI and OSTI**

ECI review should be initiated early enough to avoid conflicts with planned publication, presentation, distribution, or visit schedules, and should be consistent with guidelines implementing DOE Order 1430.1D that require contractors or Operations or Program Offices to forward reports to the Office of Scientific and Technical Information (OSTI), Oak Ridge, Tennessee, with a completed DOE Form 1332.15, Announcement and Distribution of Department of Energy (DOE) Scientific and Technical Information (STI). The form sent to OSTI will record the outcome of the ECI review, including dissemination guidance. When no dissemination guidance is given, OSTI will provide the report on request only to DOE and its major U.S. contractors unless the responsible program manager advises otherwise.

### **6.4 Reviewing for ECI**

The author of a document, in most cases, is probably the person most qualified to review it initially for ECI. DOE and DOE contractor personnel reviewing their own documents for ECI will inform their supervisors of their findings. Supervisors will ascertain that the reviewers are technically qualified and have an understanding of the factors involved in technology transfer. Supervisors also will document that ECI issues have been considered as part of the clearance process for a publication, meeting presentation, response to a foreign request for technical information, or plan for controlling access by a foreign national.

A reviewer who determines that information constitutes ECI will indicate the permissible dissemination. For example, a reviewer may authorize dissemination only to DOE and its Managing and Operating (M&O) contractors or to all Federal agencies and their U.S. contractors. The reviewer may attach to the document a list of authorized recipients or a "nondisseminntion" list of sensitive countries. In any case, ECI dissemination guidance is intended to prevent release of technical information to unauthorized foreign governments, firms and individuals unless it is reviewed and approved for release by the Headquarters Program Office. A Headquarters Program Office authorizing release to an otherwise unauthorized recipient will notify the reviewing office and OSTI of the action.

## **6.5 Recordkeeping on ECI**

ECI documentation will be maintained at reviewing offices and be available to Headquarters program managers and to the Nuclear Transfer and Supplier Policy Division. The documentation should include foreign requests for material determined to be ECI, the disposition of the request, and the reason therefor. Headquarters program managers should monitor review activities periodically to assure consistency and uniformity. ECI concerns already are reflected in the Department's Sensitive Country Information Logging System (SCILS), which now operates at the Los Alamos, Livermore, Sandia, Pacific Northwest, Oak Ridge, and Idaho national laboratories. These laboratories record in the SCILS computerized data base all requests for technical information from sensitive countries. This enables the DOE and the laboratory

managements to be confident that such requests are properly reviewed. Other DOE sites may find SCILS a valuable tool for responsible handling of requests for technical information.

## **6.6 Restrictions on Release of ECI**

A review finding that a proposed release is inconsistent with the intent of export control regulations may necessitate revision of either the content or distribution of the information. Just as DOE sometimes denies a firm's request for authorization to export technology or sets conditions on the authorization, DOE may, in the case of publication of ECI or its presentation at an international meeting, determine that U.S. nonproliferation policy requires that some of the technical content be held back or that participation by nationals of sensitive countries in the meeting be restricted. In the latter case, meeting participants will sign a commitment not to transmit the ECI to sensitive country nationals and to advise other recipients of the ECI status of the information. Abstracts or proceedings associated with such verbal presentations also will be reviewed.

## **6.7 Visits and Assignments and Foreign Travel**

In the case of a visit or assignment of a foreign national to a DOE facility, measures should be taken to control access to export controlled equipment or ECI. Similarly, a DOE or DOE contractor employee going abroad should consider ECI aspects of planned discussions. Hosts

of foreign visitors or assignees should familiarize themselves with the requirements of DOE Order

1240.2B, "Unclassified Visits and Assignments by Foreign Nationals," especially the requirements

of the DOE-wide computerized Visits and Assignments Management System (VAMS). In

planning visits and assignments, hosts should consult the Sensitive Country List (Appendix 3) and

the Sensitive Subjects List (Appendix 4). In an era of increasing collaboration between U.S. and foreign scientists, engineers, and other technical personnel at DOE facilities, it must be borne in mind that transfers of technology during such collaboration must adhere to U.S. export control laws and regulations. Such transfers usually are considered an export. Therefore, export control requirements must be considered in determining the appropriateness of foreign national access to DOE technology. *Foreign nationals not from sensitive countries may acquire most technologies without a license. But foreign nationals from sensitive countries may need a license to acquire many technologies and all foreign nationals may need a license to acquire certain technologies* <sup>2</sup>.

Similarly, DOE travelers should familiarize themselves with the requirements of DOE Order

1500.3, "Foreign Travel Authorization," and the information on planned trips that must be entered

into the Foreign Travel Management System.

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<sup>2</sup> This guidance is not intended to preclude access by DOE or contractor employees who are foreign nationals from sensitive countries if they are considered permanent resident aliens or "intending citizens" under the Immigration and Naturalization Act.

## **6.8 Establishing Export Control Review**

When no export review mechanisms exist, it is the responsibility of Headquarters offices, field offices, and program managers to arrange their establishment in Headquarters program offices, Operations and Area Offices, and contractor organizations, as necessary. If differences emerge regarding facility guidelines or their application, or if review bodies in contractor organizations or

Operations Offices are unable to make a clear determination regarding a planned publication, presentation, sale of surplus property, donation, CRADA or other transfer, they should refer the matter to the responsible Headquarters program office. If necessary, the Headquarters program office should seek the advice of the Nuclear Transfer and Supplier Policy Division, Office of Arms

Control and Nonproliferation, Telephone (202) 586-2331, Fax (202) 586-1348.

## **6.9 Developing Program or Facility Guidelines**

As experience is gained, program managers, laboratories, and other contractor facilities may decide they need more detailed "program guidelines" or "facility guidelines" for their specialized areas of activity. Such guidelines may be prepared by program managers and other experts familiar with the technologies involved. However, to ensure consistency among locally prepared and applied guidelines, these should be reviewed by the appropriate Headquarters Program Office

in coordination with the Director of the Nuclear Transfer and Supplier Policy Division.

## **APPENDIX 1**

### **Nuclear-Related Technology Categories**

The following categories of technologies are subject to U.S. Government export control for nuclear nonproliferation reasons and reflect U.S. adherence to the control lists of the Nuclear Suppliers Group (NSG). U.S. export control laws and regulations - including the regulations of the Departments of Energy, Commerce, and State, and the Nuclear Regulatory Commission reflect the multilateral agreements represented by the NSG control lists. The NSG lists are published in International Atomic Energy Agency Information Circular (INFCIRC) 254/Part 1 (NSG Trigger List) and INFCIRC 254/Part 2 (NSG Dual-Use list), as amended. The DOE Nuclear Technology Reference Book (NTRB) describes each category in greater technical detail. However, the NTRB is a technical resource document; it is not a control list and should not be used as one.

#### **1.0 Nuclear and Nuclear-Related Materials Technology**

This category comprises technologies related to the production or processing of source or special nuclear material, uranium isotope separation (enrichment), reprocessing of irradiated fuel to extract fissile materials, fabrication of nuclear fuel, and production of heavy water, tritium, or other materials of particular importance for a nuclear weapons program. These technologies, most of which are on the NSG Trigger List, all have potential for contributing to acquisition or enhancement of nuclear weapons capability and thus are of both proliferation and national

security concern. The more sensitive aspects of the technologies are classified. Nevertheless, equipment, materials, and unclassified technical information pertaining to the technologies may be

subject to export control.

The following are areas of concern related to technologies for the separation of the isotopes of uranium:

- Gaseous Diffusion Technology
- Gas Centrifuge Separation Technology
- Aerodynamic Separation Technology
- Chemical Exchange Separation Technology
- Electromagnetic Separation Technology
- Laser Isotope Separation Technology
- Plasma Separation Technology
- Uranium Hexafluoride Technology

Equipment, materials, or information related to the production of other important nuclear-related materials also are export controlled:

- Heavy Water Production Technology
- Lithium Isotope Separation Technology

Equipment, materials, or technical information related to the production of plutonium or tritium, processing of spent fuel target elements, design of automated equipment for remote handling in quantity, and development of process components capable of enduring high-radiation environments are export controlled, if they pertain to:

- Tritium Production or Processing
- Nuclear Reprocessing

## **2.0 Nuclear Reactor Technology**

Equipment, materials, or technical information for the design, development, construction, and operation of nuclear fission reactor systems are subject to export control because of both proliferation and direct military concerns. Fuel element hardware and technology and related techniques for non-destructive testing, control system technology and hardware, cooling and containment systems also may be export controlled.

Almost all reactors are covered by the NSG Trigger List. The NSG does not control naval nuclear propulsion technology per se. However, such technology is subject to the Department of State's ITAR export regulations. The following are reactor areas of concern.

- Reactor Systems
- Reactor Safety



- Electronuclear Breeder
- Fast Breeder Reactor
- Graphite-Moderated Reactor
- Heavy-Water Moderated Reactor
- Nuclear Research Facilities
- High-Temperature Gas-Cooled Reactor
- Naval Nuclear Propulsion

Reactors intended as mobile power sources may require development of high-temperature fuels, high technology energy conversion systems, and heat rejection systems, all of which also are export controlled. The NSG does not explicitly cite mobile nuclear power sources but these are covered by the Wassenaar Arrangement (the successor to COCOM), which also covers nuclear heat sources such as plutonium-238. All are subject to U.S. export controls. Specific areas of DOE concern are:

- Space Power Systems (Not on the Trigger List)
- Mobile/Portable Military Reactor Systems (Not on the Trigger List)

### **3.0 Nuclear Weapons Technology**

It is useful to separate technology applicable to concepts, design, research, development, testing, and production of nuclear weapons from that relating to the deployment of nuclear

weapons. Certain technologies central to the deployment and management of nuclear weapons by the U.S. military are subject to export controls. However, such information on the delivery performance characteristics of weapon systems (e.g., external envelopes, flight characteristics, parachutes) is generally nonnuclear and any controls on such information should derive from DOD

guidance. Transfer of equipment or unclassified information relating to PAL (Permissive Action Links) and disablement system in other than general terms should be subject to rigorous export control review, drawing upon guidance in NTRB Section 5.5.

Complex and sophisticated computer codes play an essential role in the design and development of

nuclear weapons. Codes revealing classified information, or nuclear weapons codes identified as weapons codes, are classified as Secret Restricted Data (SRD) or Confidential Restricted Data (CRD); publication or other access to these codes or their techniques and algorithms is restricted and export is possible only under government-to-government agreement. In addition, computer codes developed for other applications, but which may be associated with nuclear weapons design

could be export controlled unless the techniques and algorithms used are broadly applicable and already generally available. In general, codes developed for application to inertial confinement fusion (IF), reactor safety and operation, or astrophysical phenomena should be carefully reviewed

before being made generally available.

Special care should be taken for codes that:

- Predict material properties of high-atomic-number materials under thermodynamic conditions associated with nuclear weapon environments.
- Couple the propagation of radiation through materials to the movement of the materials.
- Contain physical models that rely on parameters deriving from nuclear weapons test data.

Experimental techniques for nuclear weapons testing and diagnosis must be considered carefully.

If the equipment or technology is essentially useful only for weapons R&D, then access to reports,

procedures, equipment, facilities, etc., should be limited to the U.S. Government and its U.S.

contractors, and dissemination to foreign nationals should be subject to rigorous export control

review. On the other hand, if the technology is only incidentally useful for weapons R&D and

can also serve other, more benign purposes, a review may determine the desirability of transfer to

U.S. industry or to friendly countries with strong nonproliferation credentials.

Weapons and weapons materials production technology - particularly information describing

production problems, solutions, and technology - should be controlled using the same test

recommended for weapons and weapons testing R&D; that is, if the equipment, materials, or

technical information is essentially of use only to weapons and weapons materials production, i.e.,

unique in application, and yet not classified, access to related equipment, materials, and

information usually should be limited to the U.S. Government and its U.S. contractors, and

dissemination to foreign nationals should be subject to rigorous export control review. Otherwise, for general purpose or widely applicable technologies, restrictions on transfers are not appropriate unless the mere fact of association with the originating agency carries sensitive implications.

Many dual-use areas of nuclear weapons technology are controlled by the NSG Dual-Use List.

More detailed explanations of areas of concern are provided in the NTRB.

- Nuclear Explosive R&D Technology
- Nuclear Explosive Production
- Special Nuclear Explosive Components
- Special Nuclear Explosive Materials

#### **4.0 Inertial Fusion Technology**

Inertial confinement fusion (IF) shares with nuclear weapons a common technological base in implosion design and diagnostic techniques. Accordingly, the guidelines developed for these areas

are appropriate for use in deciding whether equipment, materials, or information developed in IF R&D should be subject to transfer constraints. The NTRB provides detailed guidance on ICF.

## **APPENDIX 2**

### **Other Technologies of Concern**

Transfers involving other technologies often related to acquisition of nuclear weapons capability or other weapons of mass destruction should also be subject to export control review, including technologies that are advancing so rapidly that a reasonable projection of their military applications could cause aspects of them to become classified or subject to export control.

Because they are nonnuclear, these technologies are usually discussed in the MCTL and not in the NTRB. Again, note that inclusion of a technology in the MCTL is not in itself sufficient reason to restrict transfer of all equipment, materials, or information in the category; rather, it is reason to subject the specific equipment, materials, or information to export control review to determine whether restriction is warranted. Specific restrictions on exports related to these technologies are given in the Departments of State and Commerce regulations.

Technologies covered in Part I of the MCTL, "Weapons Systems Technologies," published in June 1996, with page numbers, include:

#### **1 AERONAUTICS SYSTEMS TECHNOLOGY**

- |     |                                 |     |
|-----|---------------------------------|-----|
| 1.1 | Aircraft, Fixed Wing            | 1-3 |
| 1.2 | Gas Turbine Engines             | 1-5 |
| 1.3 | Human (Crew) Systems Interfaces | 1-7 |

#### **2 ARMAMENTS AND ENERGETIC MATERIALS TECHNOLOGY**

- |     |  |      |
|-----|--|------|
| 2.1 | Ammunition, Small and Medium Caliber           | 2-3  |
| 2.2 | Bombs, Warheads, and Large Caliber Projectiles | 2-5  |
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15.2	Acoustic Sensors, Marine, Active Sonar	15-5
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### **APPENDIX 3**

#### **Sensitive Countries List**

Countries appear on this list for reasons of national security, nuclear nonproliferation, or support of terrorism. This list also is used in implementing DOE Order 1240.2B on "Unclassified Visits and Assignments by Foreign Nationals" and DOE Order 1500 on "Foreign Travel Authorization." This is the list as of March 1998.

Algeria  
Armenia  
Azerbaijan  
Belarus  
China, People's Republic of ( includes Hong Kong)  
Cuba  
Georgia  
India  
Iran  
Iraq  
Israel  
Kazakstan  
Kyrgyzstan  
Libya  
Moldova  
North Korea, Democratic People's Republic of  
Pakistan  
Russia  
Sudan  
Syria  
Taiwan  
Tajikistan  
Turkmenistan  
Ukraine  
Uzbekistan

NOTE: Given the dynamic nature of world events, other countries may, at any time, become sensitive. Therefore, caution should be exercised in dealing with citizens of countries not listed to assure that sensitive information, although unclassified in nature, is not inadvertently disclosed. This can include nuclear and other U.S. technology and economic information.

## **APPENDIX 4**

### **SENSITIVE SUBJECTS**

This is a list of areas of technical subject matter or technologies that are unclassified but may be considered to be "sensitive." The list identifies subjects related to nuclear weapons and the prevention of the proliferation of nuclear weapons, and also identifies other sensitive technologies.

Hosts, travelers, and others holding information should be aware of any constraints on releasing information about a particular topic. They should also be cautious about providing gratuitous information, and premature release of information about rapid advances, or breakthroughs, in technology. In addition, they should be cautious about providing information about supporting technologies, including that imbedded in another technology, e.g., advanced control systems incorporated into equipment.

Guidance on the scope and depth, and timeliness of releasing information should be obtained from appropriate sources. Any necessary approvals must be obtained before the release of sensitive information occurs. These may include approval by the Headquarters Program Office, or export license approvals from agencies, such as Departments of State or Commerce, or the Nuclear Regulatory Commission.

#### **Part I Topics Related to Nuclear Weapons and Nonproliferation**

1. Nuclear weapons - designs; research; development; testing.; manufacture and production; safeguards, security and controls; and the supporting technologies for these weapon activities, which are unique to, or primarily developed for, nuclear weapons or nuclear explosive devices, for example:
  - a) software - explicit information about the use of hydrodynamic and radiation transport computer codes in weapon design,
  - b) military high explosives - research and development in high crystal density ( $\geq 1.8$  gm/cc), high-performance explosives, advanced detonator design, or explosive train initiation systems,
  - c) neutron generator technology - generator target fabrication, seals technology, or high-voltage, thermal batteries,
  - d) isotope separation technology - gaseous diffusion, gas centrifuge, aerodynamic, ion exchange, electromagnetic, laser, or plasma isotope separation,
  - e) computer assisted design and manufacture - weapon component fabrication,
  - f) nuclear fuel fabrication and reprocessing technology, or
  - g) generally any state-of-the-art, weapon-related technology or weapon-specific details.

2. Nuclear explosion testing and evaluation, for example:
  - a) very fast electronic recording - oscilloscopes, pulse generators, or digitizers, or
  - b) hydrodynamic testing - high energy, flash x-ray technology.
3. Production, handling, metallurgy, and safeguards of weapon-grade fissile materials, such as  $^{233}\text{U}$ ,  $^{235}\text{U}$ , or  $^{239}\text{Pu}$  and other fissile isotopes.
4. Uranium and other special nuclear material enrichment processes, including their supporting technologies, for example:
  1.  $\text{UF}_6$  transport and, handling,
  2. nickel separator fabrication,
  3. uranium ion exchange resins, or
  4. isotope enrichment technologies, such as, gaseous diffusion, gas centrifuge, aerodynamic, ion exchange, electromagnetic, laser, or plasma isotope separation.

Note: Discussions regarding contractual and related program matters concerned with the provision of U.S. uranium enrichment services and other non-U.S. marketing activities conducted under the purview of the Office of Nuclear Energy are not considered "sensitive" subjects as defined in this Order.

3. Large-scale tritium production technology, for example:
  - a) handling - specific large-scale, tritium-gas handling procedures and techniques,
  - b) storage - high pressure or solid-state tritium storage technology,
  - c) recovery processes and chemistry, or
  - d) reactor and accelerator target fabrication processes.
4. Lithium isotope enrichment technology and production, including new, undeveloped methods.
5. Deuterium isotope enrichment technology and heavy-water production processes, either established or new state-of-the-art processes.
8. Uranium hexafluoride or tetrachloride handling, storage, or production, for example:
  - a) equipment - especially transfer equipment, such as, pumps, lines, and valves, or
  - b) processes - enrichment specific chemistry.
9. Fuel-element fabrication and production technology, for example:
  - a) handling - powder handling techniques, or
  - b) ceramic fabrication - sintering technology.
10. Fuel and target reprocessing technology.

Note: Civilian programs are not considered sensitive with respect to those countries with which DOE has an international agreement or contract.

11. Physical security and safeguards modeling systems and procedures which are unique to or primarily developed for the protection of nuclear weapons and related design and production facilities, for example:

- a) Security System Models, when configured with site specific data;
- b) Security system as-built design documentation which shows actual locations of system components, sensitivity settings, and interconnections for specific facilities;
- c) Design characteristics of activated barriers, such as cold smoke and sticky foam, used to protect DOE interests;
- d) Information on alarm systems, tamper-resistant and tamper-indicating devices, and barriers built into the existence of specific security systems or devices within components or subsystems; and
- e) Capabilities, force structure, and number of protective force personnel used for the protection of special nuclear material.

12. Production and processing reactor-grade zirconium, graphite, beryllium, and enriched boron-10 as pure materials, composites, compounds, or alloys, for example:

- a) chemical and physical characteristics - identifying specific nuclear applications with specific materials, composites, or alloys, or
- b) analysis - defining, qualitatively or quantitatively, the effects of specific impurities.

13. The designs; research; development; testing; production; safeguards, security and controls; and the supporting technologies for advanced nuclear reactor systems, space and mobile reactors, and naval reactors.

Note: The Office of Nuclear Energy requires that approval authorities at field locations ensure prior consultation with the Office of Nuclear Energy before approving any transfers involving its programs in the above described reactor technologies. Light-water, gas-cooled, and liquid-metal-cooled reactors are not considered to be "sensitive", unless one of the above topics (items 9-12) are involved.

14. Inertial Confinement Fusion (ICF) and supporting technologies, for example:

- a) capsule technology - design, development, and testing of specific capsules, or
- b) software - hydrodynamic calculations and codes.

### Activities requiring specific authorization under 10 CFR 810:

A person requires specific authorization by the Secretary of Energy before:

- a) Engaging directly or indirectly in the production of special nuclear material in any of the sensitive countries;
- b) Providing sensitive nuclear technology for an activity in any foreign country; or
- c) Engaging in or providing assistance in any of the following activities with respect to any foreign country:
  - (1) Designing production reactors or facilities for the separation of isotopes of source or special nuclear materials (enrichment), chemical processing of irradiated special nuclear material (reprocessing), fabrication of nuclear fuel containing plutonium, or the production of heavy water;
  - (2) Designing, constructing, fabricating, operating, or maintaining such reactors or facilities;
  - (3) Designing, constructing, fabricating, operating, or maintaining components, specially designed, modified, or adapted, for use in such reactors or facilities;
  - (4) Designing, constructing, fabricating, operating, or maintaining major critical components for use in such reactors or production-scale facilities; or
  - (5) Training for any of the activities described in paragraphs c) (1) - (4) above.

### **Part II Topics Related to National Security**

Unclassified information about certain technologies may be "sensitive" if it concerns the national security of the United States. There may be restrictions on the information that can be provided to a foreign national. Unclassified information is considered to be "sensitive" for national security reasons if it falls into one of the following categories:

- Export Controlled Information (ECI); requires review and may require a license; Refer to "Guidelines on Export Control and Nonproliferation."
- Information about "dual-use" technology, i.e., technology with both a peaceful and a military application; a determination must be made by the Program Office that release would not significantly improve the military capabilities of an adversary.
- Unclassified Controlled Nuclear Information (UCNI); requires Headquarters approval.

Examples of specific technologies are listed below. Detailed descriptions are given in the Militarily Critical Technologies List.

- Computer systems and computer component development, specifically designed for military application,

- Computer security procedures involving encryption,
- Secure computer-controlled communications systems,
- Computer software specifically designed for military applications,
- Advanced concepts of computer-aided design, computer-aided manufacturing, and computer-aided testing,
- Manufacturing and fabrication techniques for high performance materials,
- Directed energy systems technologies,
- Techniques for preparation of ultra-high purity semiconductor materials,
- Very high speed instrumentation and diagnostics, as may be applicable to directed energy systems and weapons development,
- High energy density batteries and fuel cells,
- Fabrication techniques for very high field, large bore superconducting magnets,
- Hypervelocity weapons technology.

### **Part III Topics Related to Economic Competitiveness and Commercialization**

Certain unclassified information is considered to be "sensitive" and is not for public release to protect U.S. economic interests and commercial competitiveness. The purpose of these restrictions is to protect information about technologies that offer opportunities for commercial development and include protection of business and technical information because of an understanding with a government agency or with U.S. industry or enterprise.

Local approval, and in some instances, approval by the Headquarters Program Office, government agency, or an involved U.S. industry or enterprise, may be necessary. Technology Transfer projects require approvals by the local Office of Research and Technology Applications (ORTA). This information may also include restrictions for export control reasons and the necessary approvals are required. (Refer to "Guidelines on Export Control and Nonproliferation").

## **GLOSSARY OF ACRONYMS**

CRADA.....	Cooperative Research and Development Agreement
CRD.....	Confidential Restricted Data
DE.....	Directed Energy
EAR.....	Department of Commerce’s Export Administration Regulations
ECI.....	Export Controlled Information
ICF.....	Inertial Confinement Fusion
INFCIRC.....	Information Circular of the International Atomic Energy Agency
ITAR.....	Department of State’s International Traffic in Arms Regulations
MCTL.....	Militarily Critical Technologies List
M&O.....	Managing & Operating DOE contractor
NPT.....	Treaty on the Non-Proliferation of Nuclear Weapons
NSG.....	Nuclear Suppliers Group
NTRB.....	Nuclear Technology Reference Book
OSTI.....	Office of Scientific and Technical Information
PAL.....	Permissive Action Links
R&D.....	Research and Development
SCILS.....	Sensitive Country Information Logging System
SNM.....	Special Nuclear Material
SRD.....	Secret Restricted Data

UCNI.....Unclassified Controlled Nuclear Information